



# NWEA MATH EXEMPLARS

Grade 4

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## Purpose

Have you ever thought about what it means for an assessment item to be aligned to a College- and Career-Readiness (CCR) mathematics standard? We have, as alignment is necessary to ensure that assessments accurately measure targeted instructional standards. True alignment requires much more than a simple match to mathematical topics. A high-quality, aligned item attends to the verbs in the standard while requiring students to demonstrate all or part of the knowledge and/or skill expressed in the standard. At the same time, an aligned assessment item will match the aspects of rigor addressed in the standard language. That is, it will attend to Conceptual Understanding, Procedural Skill and Fluency, or Application—or some combination of these. For example, a procedural standard should be assessed by a procedural item, while a conceptual standard should be assessed by a conceptual item. A high-quality, aligned item is designed to maximize the likelihood that students provide a correct response by demonstrating the knowledge or skill required in the content of the standard. High-quality items do not promote the use of mnemonics or tricks, but instead fit within the larger coherent vision of the standards. Aligned items focus on the mathematics in a specific standard, match the rigor of the standard, and complement the overall coherence of the standards.

This document presents a collection of assessment items—representative of those that students would see on NWEA® MAP® Growth™ Math assessments—that do these things, and more. The purpose of this collection is to showcase high-quality assessment items and illustrate how the alignment and rigor as intended by CCR standards are reflected in the item content of each grade-level set. Each item is accompanied by a detailed explanation that supports our alignment claims, including descriptors about the levels of rigor. For the purposes of these documents, NWEA has chosen to use the Common Core State Standards for Mathematics as the alignment resource, but teachers should consider the requirements of their individual state's standards. Each grade-level document highlights the critical key knowledge and understandings for that grade, and each item annotation describes how the item is aligned to the standard, how that standard coherently fits in the progression of standards within and across grades, and how the intended mathematical rigor of the standard is reflected in the item.

## Grade 4

### Alignment, Rigor, Coherence, Focus

The grade 4 items in this document are tightly aligned to the Common Core State Standards, attend to the rigor of the named standards, and can be described in terms of coherence in the standards. This item set is not a comprehensive summative collection of items, a reflection of how items in an assessment should be balanced, or a sample test. When reviewing the items in this set—or any assessment item—consider these important questions regarding alignment, rigor, and coherence:

- **Alignment**—*Do students have to show evidence of the standard to answer the item?*
- **Rigor**—*Does the rigor in the item match the intended rigor in the standard?*
- **Coherence**—*Does the item fit within the coherence of the standards, both between grades and within the grade?*

Because K–8 standards are organized by grade, additional consideration should be given to the key knowledge and understandings in each grade. Therefore, it is important to consider how the item connects to the focus areas of the grade.

- **Focus Areas**—*Does the item assess focus areas or support those focus areas in some way?*

The key knowledge and understandings for grade 4 are problem solving with whole numbers, including multiplicative comparison and remainders; extending place value and understanding of operations to perform multidigit arithmetic; extending understanding of fraction equivalence; performing operations with fractions; and using decimal notation for fractions. Students build upon previously learned understandings of additive comparison and multiplication as equal groups to develop an understanding of multiplication as comparison, which they apply to represent and solve multiplicative comparison problems. Students also learn how to interpret remainders in division, which helps prepare them for dividing with decimals in later grades. Students are expected to demonstrate fluency in adding and subtracting multidigit numbers and to extend their understanding of place value to multiply and divide multidigit numbers. Students further develop their understanding of fractions to recognize and generate equivalent fractions, to add and subtract fractions with like denominators to solve word problems, and to multiply a fraction by a whole number. Students also learn to use decimal notation for fractions with denominators of 10 or 100.

## Grade 4 Exemplar Item Set

Item 1

**Domain:** Operations and Algebraic Thinking

**4.OA.A:** Use the four operations with whole numbers to solve problems.

**Calculator Availability:** No

Use the information to complete the task.

Carlos painted 18 pictures. He painted 3 times as many pictures as Luis painted.

Make an equation to show the number of pictures Luis painted. Move numbers and symbols to the lines. Use the blank box to represent the number of pictures Luis painted.

<u>          </u>	=	<u>          </u>
<input type="text"/>	3	18
	+	-
	×	÷

**Alignment: 4.OA.A.2:** Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.

This content is key to grade 4 expectations because it extends students' understanding of additive comparisons to multiplicative comparisons. Instead of finding how much to add to a quantity to find a total, students need to find what factor a quantity must be multiplied by in order to find the total. This item requires students to represent the problem with an equation and a box representing the unknown quantity instead of simply requiring students to find the solution

**Coherence:** Representing word problems with equations with or without unknowns or variables is emphasized throughout the K–5 Operations and Algebraic Thinking domain<sup>K.OA.A.1, 1.OA.A.1, 2.OA.A.1, 3.OA.A.3</sup> as well as throughout the Number and Operations—Fractions domain.<sup>4.NF.B.3d, 4.NF.B.4c, 5.NF.A.2, 5.NF.B.6, 5.NF.B.7c</sup> Translating a problem into an equation prepares students for the work that they will do in grades 6 through 8, especially in the Expressions and Equations domain.

**Rigor:** This item attends to conceptual understanding and application. Students must understand which factor is being multiplied by which quantity to get the given result without being required to solve the problem. This item does not attend to procedural skill because students do not need to calculate the answer. The real-world scenario gives meaning to the operation, and the mathematics is directly indicated by the context.

**Answer Key:** This item has more than one acceptable correct response. One response is shown here.

Use the information to complete the task.

Carlos painted 18 pictures. He painted 3 times as many pictures as Luis painted.

Make an equation to show the number of pictures Luis painted. Move numbers and symbols to the lines. Use the blank box to represent the number of pictures Luis painted.

$$3 \times \square = 18$$

+

-

÷

Item 2

**Domain:** Operations and Algebraic Thinking

**4.OA.A:** Use the four operations with whole numbers to solve problems.

**Calculator Availability:** No

Use the information to answer the question.	
Arjun ran 2 miles. Lee ran 4 times as many miles as Arjun.	
How many miles did Lee run? Enter the answer in the box.	
<input type="text"/>	miles

**Alignment: 4.OA.A.2:** Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.

This content is important because it extends students' understanding of additive comparisons to multiplicative comparisons. Instead of finding how much to add to a quantity to find a total, students need to find what factor a quantity must be multiplied by in order to find the total. The language in the item reflects this shift from additive to multiplicative comparison because students are told that "Lee ran 4 times as many miles as Arjun" ran.

**Coherence:** Solving word problems that involve multiplicative comparison extends work that students started in grade 2, when they solved word problems involving additive comparisons.<sup>2.OA.A.1</sup> It also extends students' understanding of multiplication from grade 3, when they learned about multiplication as a number of groups with a certain number of objects in each group, and solved multiplication word problems.<sup>3.OA.A.1, 3.OA.A.3</sup> Understanding multiplicative comparison is an important basis for work that students will do from grade 5 to grade 8. In grade 5, students will learn to interpret whole-number and fraction multiplication as scaling, in which one factor is an amount and the other is a scaling factor. This in turn will support students' understanding of ratio concepts in grade 6<sup>6.RP.A.1, 6.RP.A.2</sup> and orders of magnitude in grade 8.<sup>8.EE.A.3</sup>

**Rigor:** This item attends to conceptual understanding, procedural skill, and application of mathematics in a real-world context. The item attends to conceptual understanding because students must understand which factor is being multiplied by which quantity to get the given result. Students use grade-level procedures to perform the calculations.



**Answer Key:**

Use the information to answer the question.

Arjun ran 2 miles. Lee ran 4 times as many miles as Arjun.

How many miles did Lee run? Enter the answer in the box.

miles

Item 3

**Domain:** Operations and Algebraic Thinking

**4.OA.A:** Use the four operations with whole numbers to solve problems.

**Calculator Availability:** No

Use the information to answer the question.	
Ana collected 37 eggs. Her sister collected 3 times as many eggs as Ana. A carton holds 6 eggs.	
What is the <u>fewest</u> number of cartons needed to hold all of the eggs?	
<input type="text"/>	cartons

**Alignment: 4.OA.A.3:** Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

This item is a multistep problem in which students must understand that when they divide the total number of eggs (148) by 6, 144 of the eggs will completely fill 24 cartons, and four eggs will be left over. The leftover eggs are the remainder, and one additional carton is needed to hold the extra four eggs.

**Coherence:** In grade 3, students learned to divide whole numbers without remainders.<sup>3.OA.A.2</sup> The work that students do with remainders in grade 4 allows them to deepen their understanding of division before they learn to divide with decimals in grade 5<sup>5.NBT.B.7</sup> and learn the standard algorithm for division in grade 6.<sup>6.NS.B.2</sup>

**Rigor:** This item attends to conceptual understanding, procedural skill, and application. The item encompasses two important grade 4 concepts because it requires students to understand multiplicative comparison and how to interpret a remainder. Students must interpret the context in order to determine the concepts necessary to solve the problem, and they must complete multiple steps to solve the problem. Students use grade-level procedures to perform the calculations.

**Answer Key:**

Use the information to answer the question.	
Ana collected 37 eggs. Her sister collected 3 times as many eggs as Ana. A carton holds 6 eggs.	
What is the <u>fewest</u> number of cartons needed to hold all of the eggs?	
<input type="text" value="25"/>	cartons



**Answer Key:** This item has more than one acceptable correct response. One response is shown here.

Use the information to complete the task.

Isabel has 120 minutes of free time. She uses it to play a game that takes 12 minutes per round. If Isabel plays 3 rounds of the game, how much free time will she have left?

Make an equation that can be used to determine the number of minutes of free time Isabel has left. Use  $M$  to represent the number of minutes. Move numbers and symbols to the lines to complete the task.

$$120 - 12 \times 3 = M$$

+

÷

Item 5

**Domain:** Operations and Algebraic Thinking

**4.OA.B:** Gain familiarity with factors and multiples.

**Calculator Availability:** No

Move numbers to the boxes to show factor pairs of 18.

<input type="text"/>	×	<input type="text"/>	= 18
<input type="text"/>	×	<input type="text"/>	= 18
<input type="text"/>	×	<input type="text"/>	= 18

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18

**Alignment: 4.OA.B.4:** Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.

This item assesses students' ability to identify the factor pairs of 18. Being fluent in multiplication and division facts supports the work students do with multiplication and division throughout grade 4. This work includes using multiplication and division to solve word problems,<sup>4.OA.A</sup> performing multi-digit arithmetic with whole numbers,<sup>4.NBT.B</sup> and applying understanding of whole-number multiplication to fraction understanding and computation.<sup>4.NF.B</sup>

**Coherence:** Identifying factor pairs extends the work with multiplication and division that students began in grade 3, specifically when students fluently multiplied and divided within 100.<sup>3.OA.C.7</sup> Identifying factor pairs allows students to deepen their understanding of basic facts and eventually will support interpreting numerical expressions in grade 5<sup>5.OA.A.2</sup> and evaluating numerical expressions in grade 6.<sup>6.EE.A.1</sup>

**Rigor:** This item attends to procedural skill and conceptual understanding. Students use conceptual understanding to recall the definition of factor pairs, and they use procedural skill to compute 18 when determining the factor pairs.

**Answer Key:** This item has more than one acceptable correct response. One response is shown here.

Move numbers to the boxes to show factor pairs of 18.

$$\boxed{18} \times \boxed{1} = 18$$

$$\boxed{9} \times \boxed{2} = 18$$

$$\boxed{6} \times \boxed{3} = 18$$

			4	5		7	8
10	11	12	13	14	15	16	17

Item 6

**Domain:** Number and Operations in Base Ten

**4.NBT.A:** Generalize place value understanding for multi-digit whole numbers.

**Calculator Availability:** No

Complete the comparisons. Move the correct symbol to each box.

5,362	<input type="text"/>	$500 + 300 + 60 + 2$
5,362	<input type="text"/>	5 thousands + 36 hundreds + 2 tens
5,362	<input type="text"/>	5 thousands + 3 hundreds + 2 tens + 6 ones

<

>

=

**Alignment: 4.NBT.A.2:** Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using  $>$ ,  $=$ , and  $<$  symbols to record the results of comparisons.

It is important in grade 4 that students deepen their understanding of place value in multi-digit whole numbers by recognizing the meaning of digits in different place values;<sup>4.NBT.A.1</sup> reading, writing, and comparing multi-digit numbers;<sup>4.NBT.A.2</sup> and rounding multi-digit numbers.<sup>4.NBT.A.3</sup> This item gives students three opportunities to interact with place value when comparing 5,362 to numbers in expanded form, and in doing so, is a better measure of students' understanding. The second comparison in this item may be particularly challenging to students since they must understand that 5 thousands + 36 hundreds + 2 tens is equal to 5,000 + 3,600 + 20 and not 5,000 + 360 + 2. Having a strong understanding of place value supports the work that students do with multi-digit computation, in particular in the Operations and Algebraic Thinking domain, in which they solve word problems.<sup>4.OA.A.3</sup>

**Coherence:** Understanding place value is emphasized throughout the Number and Operations in Base Ten domain, and there is a cluster devoted to it in almost every elementary grade level.<sup>K.NBT.A, 1.NBT.B, 2.NBT.A, 5.NBT.A</sup> In grades K–2, students learned the value of a one, the value of a ten, and the value of a hundred. By grade 4, students generalize that knowledge to understand that “in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.”<sup>4.NBT.A.1</sup> Students use this understanding to compare multi-digit whole numbers in items like this. In grade 5, students will extend their place-value understanding to decimals.<sup>5.NBT.A.3, 5.NBT.A.4</sup>

**Rigor:** This item attends to conceptual understanding, as it requires students to demonstrate their understanding of place value.

**Answer Key:**

Complete the comparisons. Move the correct symbol to each box.

5,362   $500 + 300 + 60 + 2$

5,362  5 thousands + 36 hundreds + 2 tens

5,362  5 thousands + 3 hundreds + 2 tens + 6 ones

<

>

=



Item 7

**Domain:** Number and Operations in Base Ten

**4.NBT.B:** Use place value understanding and properties of operations to perform multi-digit arithmetic.

**Calculator Availability:** No

Find the difference. Enter the answer in the box.

$$231,845 - 81,759 = \boxed{\phantom{000000}}$$

**Alignment: 4.NBT.B.4:** Fluently add and subtract multi-digit whole numbers using the standard algorithm.

In the 4.NBT.B cluster, students learn to perform multi-digit addition and subtraction, multi-digit multiplication, and multi-digit division. The only multi-digit computations in the cluster that students are expected to perform using the standard algorithm are addition and subtraction. The numbers in this item were specifically chosen to encourage students to use the standard algorithm rather than nonstandard strategies that they may have developed in earlier grades.

**Coherence:** This standard is the culmination of the multi-digit addition and subtraction progression that students have been working toward since subtraction was introduced in

kindergarten.<sup>K.OA.A.1, 1.OA.B.4, 2.NBT.B.7, 3.NBT.A.2</sup> It is important to note that students worked conceptually with addition and subtraction for four grade levels to develop understanding before they begin to use the algorithm to add and subtract multi-digit numbers. Students will use the standard algorithm to multiply in grade 5<sup>5.NBT.B.5</sup> and will use the standard algorithm to divide in grade 6.<sup>6.NS.B.2</sup>

**Rigor:** This item attends to procedural skill because students are using the standard algorithm to fluently solve a subtraction equation.

**Answer Key:**

Find the difference. Enter the answer in the box.

$$231,845 - 81,759 = \boxed{150,086}$$

Item 8

**Domain:** Number and Operations in Base Ten

**4.NBT.B:** Use place value understanding and properties of operations to perform multi-digit arithmetic.

**Calculator Availability:** No

Find the product. Enter the answer in the box.

$$\begin{array}{r} 31 \\ \times 24 \\ \hline \end{array}$$

**Alignment: 4.NBT.B.5:** Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

In grade 4, students use place-value understanding and their knowledge of the properties of operations to perform multi-digit multiplication. However, students do not need to be formally assessed on the strategies they use for multiplication. For that reason, this item solely assesses students' ability to find the correct product; it does not assess the strategies used.

**Coherence:** This standard is a continuation of multiplication work students began in grade 3.<sup>3.OA, 3.NBT.A</sup> The completion of this work will come in grade 5,<sup>5.NBT.B.5</sup> when students are expected to fluently multiply multi-digit whole numbers using the standard algorithm.

**Rigor:** This item attends to procedural skill. Students are expected only to give the product; they do not need to explain how they found the product. However, it is important to be aware that in grade 4, students should be working on conceptual understanding of multiplication, particularly place-value understanding and using the properties of operations to multiply multi-digit numbers in a non-algorithmic way.

**Answer Key:**

Find the product. Enter the answer in the box.

$$\begin{array}{r} 31 \\ \times 24 \\ \hline \end{array}$$

744

Item 9

**Domain:** Number and Operations in Base Ten

**4.NBT.B:** Use place value understanding and properties of operations to perform multi-digit arithmetic.

**Calculator Availability:** No

Use the equation to answer the question.

$$2100 \div \square = 300$$

What is the unknown number? Enter the answer in the box.

**Alignment: 4.NBT.B.6:** Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

In grade 4, students are still working on their conceptual understanding of multi-digit multiplication and division and are not expected to use the standard algorithm to multiply and divide. In order to find the unknown divisor, students must have strong conceptual grounding in the meaning of the operation and its relationship to multiplication.

**Coherence:** This standard is a continuation of work on division that students began in grade 3.<sup>3.OA, 3.NBT.A</sup> In grade 5, students will continue to divide without using the standard algorithm, but they will incorporate two-digit divisors and four-digit dividends.<sup>5.NBT.B.6</sup> Students will fluently divide multi-digit whole numbers using the standard algorithm in grade 6.<sup>6.NS.B.2</sup>

**Rigor:** This item attends to conceptual understanding and procedural skill. Because the divisor is the unknown, students must use their understanding of the relationship between multiplication and division and their understanding of place value in order to solve the problem. Students use a grade-level procedural skill to calculate the unknown value. Although the standards in the Number and Operations in Base Ten domain may appear to be heavily geared toward procedural skill, it is important that assessment and instruction of these standards attend to conceptual understanding as well.

**Answer Key:**

Use the equation to answer the question.

$$2100 \div \square = 300$$

What is the unknown number? Enter the answer in the box.

Item 10

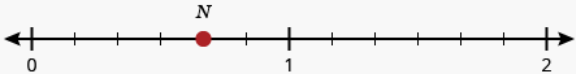
**Domain:** Number and Operations—Fractions

**4.NF.A:** Extend understanding of fraction equivalence and ordering.

**Calculator Availability:** No

Use the number line to complete the task.

Point  $N$  on the number line represents a fraction.



Make three different fractions that are equivalent to point  $N$ . Move numbers to the boxes to make the fractions.

<div><div></div><div></div></div>	<div><div></div><div></div></div>	<div><div></div><div></div></div>										
1	2	3	4	5	6	7	8	9	10	11	12	

**Alignment: 4.NF.A.1:** Explain why a fraction  $a/b$  is equivalent to a fraction  $(n \times a)/(n \times b)$  by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.

Learning that multiplying the numerator and denominator of a fraction by the same number yields an equivalent fraction is a central concept to the work that students do in grade 4 with fractions. For example, students are learning that if the number of partitions of the whole is doubled, an equivalent fraction will have twice the number of parts. This understanding must be built conceptually using models such as number lines, tape diagrams, or area models. This content helps students when they compare, add, subtract, and multiply fractions.<sup>4.NF.A.2, 4.NF.B</sup>

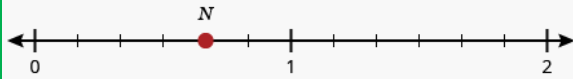
**Coherence:** Students began learning about equivalent fractions in grade 3, when they created simple equivalent fractions and when they learned that fractions are equivalent when they can be represented by the same point on a number line.<sup>3.NF.A.3</sup> Students will continue this work in grade 5, when equivalent fractions are key to adding and subtracting fractions with unlike denominators.<sup>5.NF.A</sup>

**Rigor:** This item attends to conceptual understanding because students must interpret a visual fraction model and then use it to create equivalent fractions.

**Answer Key:** There are multiple equivalent correct responses. One sample correct response is shown.

Use the number line to complete the task.

Point  $N$  on the number line represents a fraction.



Make three different fractions that are equivalent to point  $N$ . Move numbers to the boxes to make the fractions.

$\frac{4}{6}$	$\frac{2}{3}$	$\frac{8}{12}$
---------------	---------------	----------------

1

2

3

4

5

6

7

8

9

10

11

12

Item 11

**Domain:** Number and Operations—Fractions

**4.NF.A:** Extend understanding of fraction equivalence and ordering.

**Calculator Availability:** No

Move the fractions so that they are in order from least to greatest.

least	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	greatest
	$\frac{3}{8}$	$\frac{5}{6}$	$\frac{11}{12}$	$\frac{1}{2}$	

**Alignment: 4.NF.A.2:** Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as  $\frac{1}{2}$ . Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols  $>$ ,  $=$ , or  $<$ , and justify the conclusions, e.g., by using a visual fraction model.

To order fractions with different numerators and different denominators correctly, students must understand fraction part-to-whole relationships, fraction equivalence, and benchmark fractions. In this item, three-eighths and one-half were specifically chosen because three-eighths is close to one-half. If students understand equivalent fractions, they can reason that three-eighths is less than four-eighths. Five-sixths and eleven-twelfths are both close to a whole. If students understand that one-twelfth is smaller than one-sixth, they will realize that eleven-twelfths is closer to one than five-sixths is.

**Coherence:** Students began comparing and ordering fractions with either the same numerator or the same denominator in grade 3.<sup>3.NF.A.3d</sup> The fraction number sense that students develop by ordering and comparing fractions will serve them in grade 5, when they will learn to add fractions with unlike denominators.<sup>5.NF.A</sup> It also provides a basis for comparing and ordering decimals in grade 5.<sup>5.NBT.A.1, 5.NBT.A.3</sup>

**Rigor:** This item attends to conceptual understanding. Reasoning about the sizes of fractions and then ordering or comparing them is a grade-level concept for grade 4.

**Answer Key:**

Move the fractions so that they are in order from least to greatest.

least	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{6}$	$\frac{11}{12}$	greatest

Item 12

**Domain:** Numbers and Operations—Fractions

**4.NF.B:** Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.

**Calculator Availability:** No

What are two different ways to represent  $\frac{4}{7}$ ? Move numbers to the boxes to make two true equations.

$$\frac{4}{7} = \frac{\boxed{\phantom{000}}}{7} + \frac{\boxed{\phantom{000}}}{7} + \frac{\boxed{\phantom{000}}}{7}$$
$$\frac{4}{7} = \frac{\boxed{\phantom{000}}}{7} + \frac{\boxed{\phantom{000}}}{7}$$

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

**Alignment: 4.NF.B.3b:** Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model.

In grade 4, students learn to add and subtract fractions with like denominators.<sup>4.NF.B.3c</sup> Composing and decomposing fractions and understanding that a fraction is the sum of unit fractions are key conceptual underpinnings to adding and subtracting fractions. The numerator in this item was specifically chosen so that it could be decomposed in more than one way, and in doing so, is a better measure of students' understanding.

**Coherence:** Students composed and decomposed whole numbers starting in kindergarten.<sup>K.OA.A.3, K.OA.A.4</sup> Understanding the relationship between numbers less than 10 and how to make a 10 is foundational to whole-number addition and subtraction. Students continued to develop this understanding in grade 1 and grade 2.<sup>1.OA.B, 1.NBT.C, 2.OA.A.1, 2.NBT.B.5</sup> It was important that students learned to understand fractions as numbers in grade 3 so they can make connections between whole-number computation and fraction computation in grade 4 and grade 5.<sup>3.NF.A.1, 3.NF.A.2, 4.NF.B.3, 4.NF.B.4, 5.NF.A, 5.NF.B</sup>

**Rigor:** This item attends to conceptual understanding and procedural skill. Students must be able to apply what they know about fractions and decomposition of whole numbers to come up with multiple ways of composing four-sevenths. Students also need to be able to add fractions in order to complete this item, which is a grade-level procedural skill.

**Answer Key:** This item has more than one acceptable correct response. One response is shown here.

What are two different ways to represent  $\frac{4}{7}$ ? Move numbers to the boxes to make two true equations.

$$\frac{4}{7} = \frac{\boxed{1}}{7} + \frac{\boxed{1}}{7} + \frac{\boxed{2}}{7}$$

$$\frac{4}{7} = \frac{\boxed{1}}{7} + \frac{\boxed{3}}{7}$$

1

2

3

4

5

6

7

8

9



Item 13

**Domain:** Numbers and Operations—Fractions

**4.NF.B:** Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.

**Calculator Availability:** No

Use the information to answer the question.

Lucas ate a fraction of a pizza. Hugo ate  $\frac{5}{8}$  of the same pizza. Now there is  $\frac{1}{8}$  of the pizza left.

What fraction of the pizza did Lucas eat? Move numbers to the boxes to show the answer.

<div><div></div><div></div></div>									
1	2	3	4	5	6	7	8	9	

**Alignment: 4.NF.B.3d:** Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.

It is important that students understand that although fraction addition and subtraction might be performed with a different algorithm than whole-number addition and subtraction, the meaning of the operations is the same. Students need to understand fractions as numbers on a number line and should be able to represent fraction addition and subtraction on a number line just as they can represent whole-number addition and subtraction on a number line. Students should already be familiar with this type of problem from their work with whole numbers, and they must be able to apply it to a fraction context.

**Coherence:** This item assesses students' ability to solve a two-step, start-unknown addition and subtraction problem involving fractions with like denominators. Students learned about start-unknown situations in grade 1 and grade 2.<sup>1.OA.A.1, 2.OA.A.1</sup> This item also extends the work that students did in addition and subtraction, starting in kindergarten.<sup>K.OA.A.2, 1.OA.B.3, 2.OA.A.1</sup> Students apply their understanding of whole-number addition and subtraction to fraction addition and subtraction. Students will extend this work in grade 5 when they perform addition and subtraction with unlike denominators and when they perform computation with decimals.<sup>4.NF.C.5, 5.NF.A, 5.NBT.B.7</sup>

**Rigor:** This item attends to conceptual understanding, procedural skill, and application. Students apply their understanding of whole-number addition and subtraction to fraction addition and subtraction and demonstrate understanding of fractions and the whole. Students need to interpret the context to make sense of the problem because the mathematics is not directly indicated. Students then use grade-level procedural skill to solve the problem.

**Answer Key:** There are multiple equivalent correct responses. One sample correct response is shown.

Use the information to answer the question.

Lucas ate a fraction of a pizza. Hugo ate  $\frac{5}{8}$  of the same pizza. Now there is  $\frac{1}{8}$  of the pizza left.

What fraction of the pizza did Lucas eat? Move numbers to the boxes to show the answer.

2
8

1

2

3

4

5

6

7

8

9

Item 14

**Domain:** Number and Operations—Fractions

**4.NF.B:** Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.

**Calculator Availability:** No

Are the expressions in the table equal to  $4 \times \frac{2}{6}$ ? Choose "Yes" or "No" for each expression.

Expression	Equal to $4 \times \frac{2}{6}$ ?
$4 \times \frac{4}{6}$	Yes / No
$4 \times \frac{1}{3}$	Yes / No
$8 \times \frac{1}{6}$	Yes / No

**Alignment: 4.NF.B.4b:** Understand a multiple of  $a/b$  as a multiple of  $1/b$ , and use this understanding to multiply a fraction by a whole number. *For example, use a visual fraction model to express  $3 \times (2/5)$  as  $6 \times (1/5)$ , recognizing this product as  $6/5$ . (In general,  $n \times (a/b) = (n \times a)/b$ .)*

It is important that when students multiply with fractions, they apply their understanding of whole-number multiplication to fraction multiplication. This means that students should understand multiplication as a number of groups with a certain number of objects in each group or as a multiplicative comparison between two quantities. For example,  $4 \times 2/6$  can be interpreted as 4 groups of  $2/6$  or  $2/6 + 2/6 + 2/6 + 2/6$  or  $4 \times 2/6$ . The expression  $4 \times 2/6$  can also be interpreted as  $2/6$  is twice as large as  $1/6$ , so  $4 \times 2/6$  is twice as large as  $4 \times 1/6$ , and  $8 \times 1/6$  is twice as large as  $4 \times 1/6$ .

**Coherence:** Multiplying a fraction by a whole number extends the work in multiplication that students began in grade 3,<sup>3.OA.A.1</sup> and that work extends into middle school. In grade 5, students will multiply fractions by fractions and multiply decimals.<sup>5.NF.B, 5.NBT.B.7</sup> In grade 6, students will begin learning about ratios<sup>6.RP.A.2</sup> and will learn to divide fractions by fractions.<sup>6.NS.A.1</sup>

**Rigor:** This item attends to conceptual understanding and procedural skill. In this item, students complete three different comparisons with  $4 \times 2/6$  to ensure that they have a conceptual understanding of multiples of fractions. Students also perform a grade 4 procedural skill by multiplying fractions by whole numbers.

**Answer Key:**

Are the expressions in the table equal to  $4 \times \frac{2}{6}$ ? Choose "Yes" or "No" for each expression.

Expression	Equal to $4 \times \frac{2}{6}$ ?
$4 \times \frac{4}{6}$	Yes / <input type="text" value="No"/>
$4 \times \frac{1}{3}$	<input type="text" value="Yes"/> / No
$8 \times \frac{1}{6}$	<input type="text" value="Yes"/> / No

Item 15

**Domain:** Number and Operations—Fractions

**4.NF.B:** Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.

**Calculator Availability:** No

Use the information to answer the question.

Zoe ran  $\frac{3}{5}$  mile each day for 7 days.

How many miles did Zoe run in all? Move numbers to the boxes to show the answer. If there is no whole number, enter () in the first box.

miles

0

1

2

3

4

5

6

7

8

9

**Alignment: 4.NF.B.4c** Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem.

This item has students solve a one-step problem in which they multiply a fraction by a whole number. The product is a fraction that is greater than one. While  $21/5$  is a correct and acceptable solution to this item, we do not generally talk about running  $21/5$  miles per week. Students may convert the solution into a format that is more informative, such as  $4 \frac{1}{5}$  miles. Note that in grade 4, students learn to multiply a fraction by only a whole number, meaning they learn to find seven groups of three-fifths and not three-fifths of seven.

**Coherence:** This item extends the work that students began in grade 3 when they learned to multiply whole numbers and to understand multiplication as a number of groups with a certain number of objects in each group.<sup>3.OA.A.1</sup> Students will learn to solve more complex problems involving fraction multiplication and division in grade 5 and grade 6. In grade 5, students will multiply fractions by fractions and multiply decimals.<sup>5.NF.B, 5.NBT.B.7</sup> In grade 6, students will begin to learn about ratios<sup>6.RP.A.2</sup> and begin to learn to divide fractions by fractions.<sup>6.NS.A.1</sup>

**Rigor:** This item attends to conceptual understanding, application of mathematics in a real-world setting, and procedural skill. Students need to understand what it means to multiply a fraction by a whole number in order to solve the problem. In terms of how they apply their understanding of the mathematics, students might use their understanding of multiplication as equal groups, which was introduced in grade 3, or they might use their understanding of multiplication as a comparison, which is introduced in grade 4. Students use grade-level procedural skill when multiplying a whole number by a fraction.

**Answer Key:** There are multiple equivalent correct responses. One sample correct response is shown.

Use the information to answer the question.

Zoe ran  $\frac{3}{5}$  mile each day for 7 days.

How many miles did Zoe run in all? Move numbers to the boxes to show the answer. If there is no whole number, enter 0 in the first box.

$$\boxed{4} \frac{\boxed{1}}{\boxed{5}} \text{ miles}$$

0      1      2      3      4      5      6      7      8      9

Item 16

**Domain:** Number and Operations—Fractions

**4.NF.C:** Understand decimal notation for fractions, and compare decimal fractions.

**Calculator Availability:** No

Move a fraction to each box to make the equation true.

$$\frac{4}{10} + \frac{30}{100} = \frac{4}{10} + \boxed{\phantom{00}} = \boxed{\phantom{00}}$$

$\frac{30}{10}$	$\frac{3}{100}$	$\frac{3}{10}$	$\frac{43}{10}$	$\frac{7}{100}$	$\frac{7}{10}$
-----------------	-----------------	----------------	-----------------	-----------------	----------------

**Alignment: 4.NF.C.5:** Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100. *For example, express  $3/10$  as  $30/100$ , and add  $3/10 + 4/100 = 34/100$ .*

This standard is students' first introduction to adding fractions with unlike denominators. This standard is also when students are introduced to the idea of decimal fractions, or fractions that can be represented as tenths or hundredths.

**Coherence:** Students began working with equivalent fractions in grade 3.<sup>3.NF.A</sup> In grade 4, students are finding equivalent fractions and using equivalent fractions to understand decimal fractions.<sup>4.NF.A.1</sup> Decimal fractions extend the work that students did with place value in grade 1, grade 2, and grade 3.<sup>1.NBT.A.2, 2.NBT.A.1, 3.NBT.A</sup> Decimal fractions also prepare students for the work that they will do with decimals in grade 5. In grade 5, students will learn about decimal place value<sup>5.NBT.A</sup> and will perform multi-digit arithmetic with decimals.<sup>5.NBT.B</sup>

**Rigor:** This item attends to conceptual understanding and procedural skill. Students need to understand how equivalent fractions can be used to support addition. The calculations that students will do to generate an equivalent fraction and to add the fractions are both grade-level procedural skills.

**Answer Key:**

Move a fraction to each box to make the equation true.

$$\frac{4}{10} + \frac{30}{100} = \frac{4}{10} + \boxed{\frac{3}{10}} = \boxed{\frac{7}{10}}$$

$\frac{30}{10}$	$\frac{3}{100}$	$\frac{43}{10}$	$\frac{7}{100}$
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Item 17

**Domain:** Number and Operations—Fractions

**4.NF.C:** Understand decimal notation for fractions, and compare decimal fractions.

**Calculator Availability:** No

Use the number line to answer the question.



What number is located at point  $N$  on the number line? Write the number as a fraction and as a decimal. Enter the answers in the boxes.

**Alignment: 4.NF.C.6:** Use decimal notation for fractions with denominators 10 or 100. *For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.*


In this cluster, grade 4 students are introduced to the idea of decimal fractions, or fractions that can be represented as tenths or hundredths. This item directly assesses whether a student can correctly write a number in both fraction and decimal form.

**Coherence:** Decimal fractions extend the work that students did with place value in grades 1–3. <sup>1.NBT.A.2, 2.NBT.A.1, 3.NBT.A</sup> By gaining an understanding of decimal fractions in grade 4, students will be prepared for the work they will do with decimals in grade 5, when they will learn about decimal place value <sup>5.NBT.A</sup> and will perform multi-digit arithmetic with decimals. <sup>5.NBT.B</sup>

**Rigor:** This item attends to conceptual understanding. Students use the number line to identify a number between 0 and 1 and then write it in both decimal and fraction form. This is a grade-level concept.

**Answer Key:**

Use the number line to answer the question.



What number is located at point  $N$  on the number line? Write the number as a fraction and as a decimal. Enter the answers in the boxes.

63

100

0.63



Item 18

**Domain:** Number and Operations—Fractions

**4.NF.C:** Understand decimal notation for fractions, and compare decimal fractions.

**Calculator Availability:** No

Move a symbol to each box to make the comparisons true.

0.10	<input type="text"/>	0.06
0.89	<input type="text"/>	2.3

---

< > =

**Alignment: 4.NF.C.7:** Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols  $>$ ,  $=$ , or  $<$ , and justify the conclusions, e.g., by using a visual model.

Students are introduced to decimals in grade 4 and must develop decimal number sense by reasoning about the size of decimal numbers and comparing and ordering them. The numbers in this item were specifically chosen to assess students' understanding of place value with decimals. The lower values have digits of greater value. It is the place value of those digits that determines their value.

**Coherence:** Students are first introduced to decimals in grade 4, when they extend their understanding of fractions to decimals.<sup>4.NF.C</sup> In grade 5, students will learn about decimal place value<sup>5.NBT.A</sup> and perform multi-digit arithmetic with decimals.<sup>5.NBT.B</sup>

**Rigor:** This item attends to conceptual understanding. Reasoning about the sizes of decimals and then comparing them is a grade-level concept.

**Answer Key:**

Move a symbol to each box to make the comparisons true.

0.10	<input type="text" value="&gt;"/>	0.06
0.89	<input type="text" value="&lt;"/>	2.3

---

< > =

Item 19

**Domain:** Measurement and Data

**4.MD.A:** Solve problems involving measurement and conversion of measurements.

**Calculator Availability:** No

How many meters are in 7 kilometers? Enter the answer in the box.

<input type="text"/>	meters
----------------------	--------

**Alignment: 4.MD.A.1:** Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table.

In grade 4, students convert measurements and learn the size of different units of measurement in relation to each other. This item requires students to convert between kilometers and meters. If students know that there are 100 meters in 1 kilometer, they can use their understanding of place value to determine the answer. Alternatively, students may use multiplication. The number of kilometers in this item is less than 10, therefore the multiplication required is consistent with the multi-digit multiplication limits set in standard 4.NBT.B.5.

**Coherence:** This item reflects the work students did with length measurement in grade 2<sup>2.MD.A.1</sup> and the work they did with measurement and problem solving with liquid volumes and masses in grade 3.<sup>3.MD.A.2</sup> This item also extends work with multiplication and division within 100 that students began in grade 3.<sup>3.OA.C.7</sup> In grade 5, students will do measurement conversions for which they express measurements in a smaller unit in terms of a larger unit.<sup>5.MD.A.1</sup> Expressing measurements in terms of larger or smaller units prepares students for the work with ratios they will do in grade 6.<sup>6.RP.A.1</sup>

**Rigor:** This item attends to conceptual understanding and procedural skill. The item has multiple entry points for students; they may use place-value understanding or their understanding of multiplication to find the answer. Multiplying a one-digit number by a four-digit number is a grade-level procedural skill.

**Answer Key:**

How many meters are in 7 kilometers? Enter the answer in the box.

7,000	meters
-------	--------

Item 20

**Domain:** Measurement and Data

**4.MD.A:** Solve problems involving measurement and conversion of measurements.

**Calculator Availability:** No

Use the information to answer the question.

Sasha bought 12 yards of lumber. The lumber cost \$18 per foot.

How much did Sasha spend on lumber? Enter the answer in the box.

dollars

**Alignment: 4.MD.A.2:** Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

Solving problems involving measurement supports the work that grade 4 students do with problem solving in the Operations and Algebraic Thinking domain, computation with fractions in the Number and Operations—Fractions domain, and the multi-digit computation that they do in the Number and Operations in Base Ten domain. This item requires students to complete a word problem that involves converting yards to feet and then finding the total cost. It also supports standard 4.NBT.B.5 because it requires students to multiply a two-digit number by a two-digit number.

**Coherence:** This item reflects the work students did with length measurement and money in grade 2<sup>2.MD.A.1, 2.MD.C.8</sup> and the work they did with measurement and problem solving with liquid volumes and masses in grade 3.<sup>3.MD.A.2</sup> In grade 5, students will perform measurement conversions for which they express measurements in a smaller unit in terms of a larger unit.<sup>5.MD.A.1</sup> Expressing measurements in terms of larger or smaller units prepares students for the work they will do with ratios in grade 6.<sup>6.RP.A.1</sup>

**Rigor:** This item attends to conceptual understanding, procedural skill, and application. Students use their conceptual understanding of the relationship between measurement units to convert from yards to feet, or vice versa. Students perform a grade-level procedural skill when they multiply a two-digit number by a two-digit number. The context requires some interpretation, because students must recognize that they need to either determine the number of feet of lumber or find the cost in terms of yards in order to calculate the total cost.

**Answer Key:**

Use the information to answer the question.

Sasha bought 12 yards of lumber. The lumber cost \$18 per foot.

How much did Sasha spend on lumber? Enter the answer in the box.

dollars

Item 21

**Domain:** Measurement and Data

**4.MD.B:** Represent and interpret data.

**Calculator Availability:** No

Use the line plot to answer the question.

Leon recorded the distance that he swam each day for a week.

**Distance Swam**

Distance (miles)

About how many miles did Leon swim?

☐ A. between 3 and 4 miles

☐ B. between 4 and 5 miles

☐ C. between 5 and 6 miles

☐ D. between 6 and 7 miles

**Alignment: 4.MD.B.4:** Make a line plot to display a data set of measurements in fractions of a unit ( $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{1}{8}$ ). Solve problems involving addition and subtraction of fractions by using information presented in line plots.

This item attends to the data portion of the Measurement and Data standards for grade 4. This item assesses the second part of the standard—“solve problems involving addition and subtraction of fractions”—rather than addressing the first part, “make a line plot.”

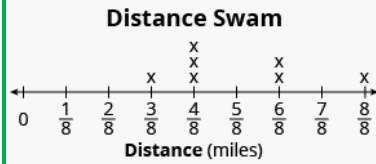
**Coherence:** Students first worked with line plots in grade 3, when they created line plots representing data in halves and fourths.<sup>3.MD.B.4</sup> This standard is purposefully designed to support the work students do in the grade 4 Number and Operations—Fractions domain, in which they order fractions and add and subtract fractions with like denominators.<sup>4.NF.A, 4.NF.B</sup> Students will continue working with line plots in grade 5.<sup>5.MD.B.2</sup> It is important that students become familiar with line plots in grades 3–5 because they will use line plots when they learn about measures of center in grade 6.<sup>6.SP.A, 6.SP.B</sup>

**Rigor:** This item attends to conceptual understanding, procedural skill, and application. Students use conceptual understanding to read the line plot and to recognize that the answer,  $\frac{35}{8}$ , is a number that lives somewhere between the whole numbers four and five. Students use grade-level procedural skill when adding some or all the fractions on the line plot to determine the approximate number of miles that Leon swam during the week. The context is straightforward and does not require a great deal of interpretation.

**Answer Key:**

Use the line plot to answer the question.

Leon recorded the distance that he swam each day for a week.



About how many miles did Leon swim?

- ☐ A. between 3 and 4 miles
- ☒ B. between 4 and 5 miles
- ☐ C. between 5 and 6 miles
- ☐ D. between 6 and 7 miles

Item 22

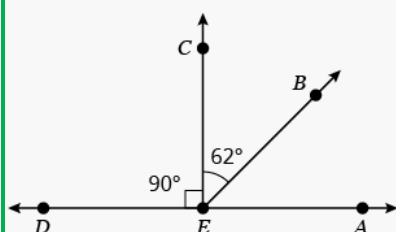
**Domain:** Measurement and Data

**4.MD.C:** Geometric measurement: understand concepts of angle and measure angles.

**Calculator Availability:** No

Use the diagram to answer the question.

The measure of  $\angle DEA$  is  $180^\circ$ .



What is the measure of  $\angle AEB$ ? Enter the answer in the box.

**Alignment: 4.MD.C.7:** Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.

This item assesses students' understanding of angle measurement. Grade 4 students should understand that angle measurements are additive and can be composed and decomposed.

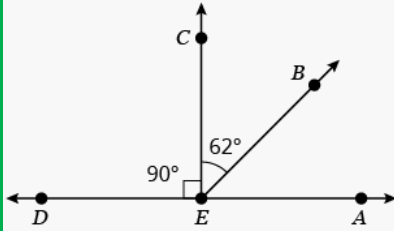
**Coherence:** Students first learn about concepts of angles and measuring angles in grade 4. They will apply what they learn about angles to classify shapes in grade 4 and grade 5.<sup>4.G.A.2, 5.G.B</sup> In grade 7, students will extend their knowledge of angle addition and properties when they learn to solve problems involving angle measures.<sup>7.G.B.5</sup>

**Rigor:** This item attends to conceptual understanding and procedural skill. Students must understand grade-level angle concepts in order to determine the measure of angle AEB. Students use procedural skill when they determine the unknown angle measure.

**Answer Key:**

Use the diagram to answer the question.

The measure of  $\angle DEA$  is  $180^\circ$ .



What is the measure of  $\angle AEB$ ? Enter the answer in the box.

$^\circ$

Item 23






**Domain:** Geometry

**4.G.A:** Draw and identify lines and angles, and classify shapes by properties of their lines and angles.

**Calculator Availability:** No

Move shapes to the table to sort them.

Appears to Have 1 or More Right Angles	Appears to Have No Right Angles



**Alignment: 4.G.A.2:** Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.

In the grade 4 Measurement and Data domain, students are introduced to angle concepts and angle measurement. This ties into the work they do in the Geometry domain when they classify shapes based on angle properties, particularly with right triangles. In this item, the student must attend to classifying figures based on the presence or absence of angles of a specified size.






**Coherence:** Students informally learn names of shapes and their attributes in the primary grades. Starting in grade 3, students learned to group shapes according to their attributes.<sup>3.G.A.1</sup> Students extend this work into grade 4, and they will extend it even further in grade 5, when they will classify shapes into categories and hierarchies.<sup>5.G.B</sup>

**Rigor:** This item attends to conceptual understanding. Students use the grade-level concept of right angles to sort the shapes.



Answer Key:

Move shapes to the table to sort them.

Appears to Have 1 or More Right Angles	Appears to Have No Right Angles
  	 

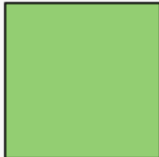
Item 24

**Domain:** Geometry

**4.G.A:** Draw and identify lines and angles, and classify shapes by properties of their lines and angles.

**Calculator Availability:** No

Use the square to answer the question.



How many lines of symmetry does the square have? Enter the answer in the box.

**Alignment: 4.G.A.3:** Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.


The emphasis in the grade 4 Geometry domain is lines and angles. Students learn terms such as *parallel* and *perpendicular*, and they learn about lines of symmetry. This is a straightforward item that assesses if students can recognize a line of symmetry and determine how many lines of symmetry can be drawn on the square.

**Coherence:** The work students do in grade 4 with angles and lines provides a foundation for the grade 5 Geometry domain, for which they will use angle and line properties to classify shapes and place them in hierarchies.<sup>5.G.B</sup> Grade 4 work also prepares students for the coordinate plane in grade 5.<sup>5.G.A</sup> Students need to understand properties of lines (e.g., perpendicularity) and angles in order to understand the coordinate plane.

**Rigor:** This item attends to conceptual understanding. Students use the grade-level concept of lines of symmetry to identify all the lines of symmetry that a square has.

**Answer Key:**

Use the square to answer the question.



How many lines of symmetry does the square have? Enter the answer in the box.

## Appendix

### NWEA and MAP Growth Math

NWEA is a research-based, not-for-profit organization that supports students and educators worldwide. For forty years, NWEA has developed assessments and professional learning offerings to help advance all students along their optimal learning paths.

This document presents a collection of assessment items representative of those that students would see on NWEA MAP Growth Math assessments. NWEA MAP Growth Math assessments reveal how much growth has occurred between testing events and, when combined with our norms, show projected proficiency. Educators can track growth through the school year and over multiple years.

### College- and Career-Readiness Shifts in Mathematics

Over the past decade, states have adopted CCR mathematics standards that emphasize focus, coherence, and rigor, which are now reflected in instructional materials, classroom practice, and assessment. CCR standards contribute to transformative changes in the classroom and better prepare students for opportunities following high school.

#### Focus

The Common Core and other CCR standards call for a sharper focus in mathematics. Rather than racing to cover topics in a mile-wide, inch-deep curriculum, CCR standards require teachers to significantly narrow and deepen the ways instructional time and energy are spent in the math classroom.

Teachers should spend most of their instructional time on the key knowledge and understandings of the grade. The remaining standards within a grade will support and engage students in the major work of the grade. Some organizations, like Student Achievement Partners, recommend that at least 65%—and up to approximately 85%—of class time should be devoted to those areas.

Table 1 shows the key knowledge and understandings of grades K–8, adapted from Student Achievement Partner’s *Highlights of Major Work in Grades K–8*. Table 2 shows the major work of grades K–8, which is adapted from Student Achievement Partner’s *Focus by Grade Level*.

Table 1: Key Knowledge and Understandings of Grades K–8

Grade	Key Knowledge and Understandings
K	Counting and number sense; understanding the meaning of addition and subtraction; and introduction to place value
1	Concepts and strategies for addition and subtraction; whole numbers and place value; and understanding and measuring length
2	Place value; addition and subtraction; problem solving with addition and subtraction; and measurement with standard units
3	Multiplication and division of whole numbers; fraction concepts; problem solving; and area concepts
4	Place value; fluency with addition and subtraction; fraction equivalence and ordering; operations with fractions; decimal notation for fractions; and problem solving
5	Decimal place value and operations; fluency with whole-number and decimal operations; addition and subtraction of fractions with unlike denominators; multiplication of fractions and division involving whole numbers and unit fractions; and volume
6	Ratios and proportional reasoning; expressions and equations; division of fractions; and the extension to the rational number system
7	Ratios and proportional relationships; expressions and equations; and arithmetic of rational numbers
8	Linear equations; concept of functions; congruence and similarity in terms of transformations; and the Pythagorean Theorem

Table 2: Major Work, K–8

K	1	2	3	4	5	6	7	8
<b>Counting and Cardinality</b> <ul style="list-style-type: none"> <li>• Know number names and the count sequence.</li> <li>• Count to tell the number of objects.</li> <li>• Compare numbers.</li> </ul>								
<b>Operations and Algebraic Thinking</b> <ul style="list-style-type: none"> <li>• Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.</li> </ul>	<b>Operations and Algebraic Thinking</b> <ul style="list-style-type: none"> <li>• Represent and solve problems involving addition and subtraction.</li> <li>• Understand and apply properties of operations and the relationship between addition and subtraction.</li> <li>• Add and subtract within 20.</li> <li>• Work with addition and subtraction equations.</li> </ul>	<b>Operations and Algebraic Thinking</b> <ul style="list-style-type: none"> <li>• Represent and solve problems involving addition and subtraction.</li> <li>• Add and subtract within 20.</li> </ul>	<b>Operations and Algebraic Thinking</b> <ul style="list-style-type: none"> <li>• Represent and solve problems involving multiplication and division.</li> <li>• Understand properties of multiplication and the relationship between multiplication and division.</li> <li>• Multiply and divide within 100.</li> <li>• Solve problems involving the four operations, and identify and explain patterns in arithmetic.</li> </ul>	<b>Operations and Algebraic Thinking</b> <ul style="list-style-type: none"> <li>• Use the four operations with whole numbers to solve problems.</li> </ul>		<b>Expressions and Equations</b> <ul style="list-style-type: none"> <li>• Apply and extend previous understandings of arithmetic to algebraic expressions.</li> <li>• Reason about and solve one-variable equations and inequalities.</li> <li>• Represent and analyze quantitative relationships between dependent and independent variables.</li> </ul>	<b>Expressions and Equations</b> <ul style="list-style-type: none"> <li>• Use properties of operations to generate equivalent expressions.</li> <li>• Solve real-life and mathematical problems using numerical and algebraic expressions and equations.</li> </ul>	<b>Expressions and Equations</b> <ul style="list-style-type: none"> <li>• Work with radicals and integer exponents.</li> <li>• Understand the connections between proportional relationships, lines, and linear equations.</li> <li>• Analyze and solve linear equations and pairs of simultaneous linear equations.</li> </ul>
<b>Number and Operations in Base Ten</b> <ul style="list-style-type: none"> <li>• Work with numbers 11–19 to gain foundations for place value.</li> </ul>	<b>Number and Operations in Base Ten</b> <ul style="list-style-type: none"> <li>• Extend the counting sequence.</li> <li>• Understand place value.</li> <li>• Use place value understanding and properties of operations to add and subtract.</li> </ul>	<b>Number and Operations in Base Ten</b> <ul style="list-style-type: none"> <li>• Understand place value.</li> <li>• Use place value understanding and properties of operations to add and subtract.</li> </ul>		<b>Number and Operations in Base Ten</b> <ul style="list-style-type: none"> <li>• Generalize place value understanding for multi-digit whole numbers.</li> <li>• Use place value understanding and properties of operations to perform multi-digit arithmetic.</li> </ul>	<b>Number and Operations in Base Ten</b> <ul style="list-style-type: none"> <li>• Understand the place value system.</li> <li>• Perform operations with multi-digit whole numbers and with decimals to hundredths.</li> </ul>	<b>The Number System</b> <ul style="list-style-type: none"> <li>• Apply and extend previous understandings of multiplication and division to divide fractions by fractions.</li> <li>• Apply and extend previous understandings of numbers to the system of rational numbers.</li> </ul>	<b>The Number System</b> <ul style="list-style-type: none"> <li>• Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.</li> </ul>	

	<b>Measurement and Data</b> <ul style="list-style-type: none"> <li>• Measure lengths indirectly and by iterating length units.</li> </ul>	<b>Measurement and Data</b> <ul style="list-style-type: none"> <li>• Measure and estimate lengths in standard units.</li> <li>• Relate addition and subtraction to length.</li> </ul>	<b>Measurement and Data</b> <ul style="list-style-type: none"> <li>• Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.</li> <li>• Geometric measurement: understand concepts of area and relate area to multiplication and to addition.</li> </ul>		<b>Measurement and Data</b> <ul style="list-style-type: none"> <li>• Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.</li> </ul>			<b>Geometry</b> <ul style="list-style-type: none"> <li>• Understand congruence and similarity using physical models, transparencies, or geometry software.</li> <li>• Understand and apply the Pythagorean Theorem.</li> </ul>
			<b>Number and Operations—Fractions</b> <ul style="list-style-type: none"> <li>• Develop understanding of fractions as numbers.</li> </ul>	<b>Number and Operations—Fractions</b> <ul style="list-style-type: none"> <li>• Extend understanding of fraction equivalence and ordering.</li> <li>• Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.</li> <li>• Understand decimal notation for fractions, and compare decimal fractions.</li> </ul>	<b>Number and Operations—Fractions</b> <ul style="list-style-type: none"> <li>• Use equivalent fractions as a strategy to add and subtract fractions.</li> <li>• Apply and extend previous understandings of multiplication and division to multiply and divide fractions.</li> </ul>			
						<b>Ratios and Proportional Relationships</b> <ul style="list-style-type: none"> <li>• Understand ratio concepts and use ratio reasoning to solve problems.</li> </ul>	<b>Ratios and Proportional Relationships</b> <ul style="list-style-type: none"> <li>• Analyze proportional relationships and use them to solve real-world and mathematical problems.</li> </ul>	<b>Functions</b> <ul style="list-style-type: none"> <li>• Define, evaluate, and compare functions.</li> <li>• Use functions to model relationships between quantities.</li> </ul>

Adapted from Student Achievement Partners, <https://achievethecore.org/category/774/mathematics-focus-by-grade-level>

## Coherence

CCR standards progress coherently from grade to grade and link to major topics within grades.

- **Thinking across Grades:** CCR standards are designed around coherent progressions from grade to grade. Learning is carefully connected across grades so that students can build new understanding on foundations constructed in previous years. Each standard is part of a larger story; no standard is isolated.
- **Linking to Key Areas of Focus:** Instead of allowing supportive topics to detract from the focus of the grade, these concepts serve the grade-level key areas of focus. For example, instead of data displays being an end in themselves, they are an opportunity to do grade-level computation in an application setting.

See Achieve the Core's [Coherence Map](#) for an interactive tool that shows progressions within the Common Core State Standards for Mathematics.

## Rigor

CCR standards, especially in major topics, pursue conceptual understanding, procedural skill and fluency, and application with equal intensity.

- **Conceptual Understanding:** CCR standards call for conceptual understanding of key concepts such as place value and operations. Students must be able to access concepts from a variety of perspectives to enable the students to see mathematics as more than a set of mnemonics or discrete and disconnected procedures.
- **Procedural Skill and Fluency:** CCR standards call for flexibility, efficiency, and accuracy in calculation. Students learn core procedures, such as multidigit multiplication, in order to have access to more complex concepts and procedures.
- **Application:** CCR standards call for students to use mathematics flexibly for applications in problem-solving contexts.

## Equity and Accessibility Considerations

A major component of equity in assessment and instruction is accessibility. A primary goal of NWEA is to develop assessments that are fair and equitable to all students. We write every item to be accessible with well-aligned content and grade-appropriate contexts that are familiar or understandable by all students.

NWEA uses multiple readability measures to ensure grade-appropriate vocabulary. NWEA encourages teachers to use the vocabulary found in grade-level standards with their students in the classroom. The kindergarten and grade 1 item sets show audio icons with each item. This signals that NWEA products offer appropriate audio support to students at these lower grades. Students can replay audio for individual parts of items designed for these grade levels.

## Item Functionality and Scoring

### Item Types

The following item types are used in this item set:

- **Choice:** Students select one out of four or five options.
- **Choice Multiple:** Students select two or more options out of five to eight total options.
- **Drag and Drop:** Students move digits or objects into onscreen containers. Examples include filling in data in a graph or placing a number on a number line.
- **Text Entry:** Students use the keyboard to type in a numerical response.
- **Hot Text:** Students select text to indicate their response.

### Scoring

Each item shows one correct response; however, some items may have multiple equivalent correct responses. For example, text entry items may have mathematically equivalent correct responses such as “31.1,” “031.1,” and “31.10.” Similarly, drag-and-drop items may require students to create a fraction or expression, and equivalent fractions or expressions are counted and keyed appropriately.

### Calculators

For the MAP Growth Math assessment, calculators are not provided for items assessing K–5 standards. Items assessing standards for grade 6 and above have an appropriate calculator available to students when the calculator tool can assist in the required calculation and the calculation is not the skill being assessed. For example, a geometry item that requires students to determine the circumference of a circle would include a scientific calculator because the item is assessing students’ knowledge of circles and related formulas, not multiplication skills, and the scientific calculator allows students to square values and provides values of  $\pi$ .

## References

1. [College- and Career-Ready Shifts in Mathematics](#), Achievethecore.org
2. [CCSSO Criteria for High Quality Assessments](#), CCSSO.org
3. [Coherence Map](#), Achievethecore.org
4. [Mathematics Glossary, Table 1](#), Corestandards.org